A STUDY ON PROMOTIVE PROPERTIES OF MILK PREPARED WITH SELECTED HERBAL FLAVOURS

A
SYNOPSIS
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RESEARCH WORK PROPOSED TO BE CARRIED OUT IN PURSUANCE OF THE REQUIREMENT FOR THE AWARD OF DEGREE OF
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INTRODUCTION

Since times immemorial, milk has been considered to be a complete and balanced food rich in proteins, carbohydrates, fats, enzymes, vitamins, minerals, cholesterol and beneficial bacteria. Milk is produced by mammals to supply nutrition and immunological protection to their young ones. For weeks or months, milk is the only food consumed by the young ones in some species since milk provides all nutritive requirements such as energy, amino acids, minerals, and vitamins needed for growth and maintenance.

As per the latest data available with NDDB (National Dairy Development Board) the milk production has touched 165.4 MT in 2016-2017 with per capita availability of 355 gms/day (www.nddb.org/information/stats/milkprodindia).

In recent times acceptability of milk is being enhanced through value addition using various flavours and is capturing a sizable chunk of the market. Several flavours such as vanilla, strawberry, mango, elaichi (cardamom), almond, chocolate, coffee, root bear, pineapple, rose, butterscotch find uses in the flavouring industry.

The best way to flavour is the use of natural ingredients, which are also safe for consumption. However, flavouring through natural ingredients is limited to their availability, consistency of flavour and long term storage issues. Chemical analysis and chromatography techniques have isolated thousands of molecules that can impart artificial flavour to milk. Long term effects of these chemical flavouring agents on humans is yet to be understood fully. Therefore, use of natural flavours is being seriously considered and is gaining more and more market acceptability.

Milk is also being used as a delivery system for ayurvedic herbs. Such ayurvedic herb infused milk is getting market acceptability. Plant extracts and powders are a natural source of antioxidants and are extensively used to improve the quality and nutritional value of foods. Among natural antioxidants,

phenolic compounds, flavonoids and other secondary metabolites are of special interest as they are widely distributed across the plant kingdom. Milk flavoured with Tulsi (*Ocimum*), Ashwagandha (*Withania*), Ginger (*Zingiber*) are some examples that have market acceptability.

Milk adulteration is an issue that needs to be seriously considered. Adulteration is being carried by not only small time traders but also at industry and multinational company levels. The main reason for such adulteration is to increase profitability. The recent example of Chinese companies adding water and melamine to increase apparent protein is a serious case of adulteration exposed at international level (Sharma et al. 2010). Several adulterants of milk that have been identified include: urea, starch, detergent, synthetic milk, coal tar amongst others.

A recent study has shown that one glass of raw cow milk contains as many as 20 chemicals which include natural pain killers, hormones, antibiotics etc. It was found that the raw milk produced in dairy plants in the city of Sarab in Iran contained M1 aflatoxin which is harmful for health (Shamoom et al. 2016). Such chemicals are surely to be avoided both by children and adults. Therefore, going for organic feeding and use of minimal compounds is the only solution to avoid such contamination. This is another aspect that should be taken care of while preparing flavoured and Ayurvedic herb infused milk. In this context rearing of cattle under hygienic conditions with minimal use of antibiotics and fed on organically grown feed becomes important to minimize the adulterant load in the milk.

Shelf life of flavoured and ayurvedic infusion milks is increased by removing bacteria through heat sterilization. However, heat plays a significant role in chemical interactions between milk protein, amino acids, added sugars, flavours and herbal extracts that may end up in changing the original flavour and constitution of the milk. Other alternate methods as membrane filtration, high pressure or electric pulse treatment could be considered to exclude bacterial contamination.

OBJECTIVES

There is an increase in demand for natural flavours and ayurvedic herbal infused milk using milk from organically fed cattle. Use of natural extracts or ingredients requires standardization of techniques to increase shelf life of such milk. The present study has been undertaken with the following objectives:

1) To identify and select certain ayurvedic herbs for infusing with milk.

2) To study the physico-chemical changes brought in milk by the selected flavours and ayurvedic herbs.

3) To study antimicrobial and antioxidant properties of the infused milk.

4) To study methods to increase shelf life of the infused milk.

5) To study the organoleptic acceptability of the infused milk.

REVIEW OF LITERATURE AND NEED OF THE STUDY

Technically "Flavoured milk" is a product that contains raw milk in which whole nuts (fragmented or grounded), elaichi (cardamom), badam (almonds), chocolate, cocoa powder, coffee, or any other edible food colour or flavours and cane sugar have been added.

Relation between milk and Ayurvedic herbs

Since Vedic times health benefits of milk have been enhanced through use of herbal infusions. This co-relation is used for prevention against a list of diseases and to overcome nutritional deficiencies. Nutritional deficiency is almost impossible to avoid in these modern times, thus natural supplements help in overall growth, development and enhanced immunity. Herbs are also useful in getting rid of toxins accumulating in the body. India as a country is rich in different herbs that have been used for various medicinal purposes (Mazid et al. 2012).

The major herbs or spices that are commonly available in India are:

1) Black Pepper (*Piper nigrum*, Piperaceae; Kali Mirch)

Medicinal value/benefits: It is a good source of magnesium, copper, calcium, iron and phosphorus. It helps in improving digestion as consumption of pepper increases the hydrochloric acid secretion in the stomach. It helps in weight loss and helps in skin care aspect because piperine content of pepper can stimulate the skin to produce melanocyte pigment. It is also used to treat chronic bronchitis, asthma, constipation, diarrhea, cholera, chronic malaria, stomach ache and diseases of the spleen, cough and tumours (Kumar et al. 2010).

2) Ginger (*Zingiber officinale*, Zinziberaceae; Adarak)

Medicinal value/benefits: Ginger contains gingerol, a substance with powerful medicinal properties.

Ginger can treat many forms of nausea, especially morning sickness. Herbal medicines have been shown to be effective antiemetics, and among various plants studied, the rhizome of ginger has been used as a broad-spectrum antiemetic in various traditional systems of medicine for over 2000 years. Ginger has anti-inflammatory properties. It also speeds up emptying of the stomach which can be beneficial for indigestion and stomach related discomfort (Shirin et al. 2010). Because of the above benefits ginger has also been used in making enriched jaggery of different sugarcane varieties (Nayaka et al. 2015).

3) Turmeric (*Curcuma longa*, Zinziberaceae; Haldi)

Medicinal value/benefits: Turmeric has powerful anti-inflammatory and antioxidant properties. It is also a natural painkiller. It has potential against various hard to cure diseases such as cancer and Alzheimer's disease (Nasri et al. 2014)

4) Chilli (*Capsicum annuum*, Solanaceae; Mirch)

Medicinal value/benefits: Chillies have antioxidants and therefore they protect the body against cancer and have beneficial effects on the cardiovascular system. In chilli, more than 200 constituents have been identified and some of its active constituents play numerous beneficial roles in various gastrointestinal disorders such as stimulation of digestion and gastromucosal defense, reduction of Gastroesophageal Reflux Disease (GERD) symptoms, inhibition of gastrointestinal pathogens, ulceration and cancers (Maji et al. 2016).

5) Cardamom (*Elettaria cardamomum*, Zinziberaceae; Elaichi)

Medicinal value/benefits: Cardamom prevents colorectal cancer. It is good for cardiovascular health and acts as an anti depressant, prevents gastrointestinal diseases, and has anti-microbial properties. Since it lowers blood pressure the herb is used in treatment of hypertension and epilepsy due to its diuretic and sedative effects (Gilani et al. 2007).

6) Celery (*Apium graveolens*, Apiaceae; Ajvaayan)

Medicinal value/benefits: It helps to lower cholesterol and inflammation. It helps prevent high blood pressures and ulcers, boosts digestion and reduces bloating. Celery oil has high antioxidant property and the main compound is limonene (74.6 % composition) (Wei and Shibamato 2007).

7) Fenugreek (*Trigonella foenum-graecum*, Fabaceae; Methi)

Medicinal value/benefits: Fenugreek is a good source of antioxidants. It reduces cholesterol, promotes milk flow during child feeding, minimizes or prevents lipid oxidation in foods (Rababah et al. 2004).

8) Fennel (*Foeniculum officinale*, Apiaceae; Saunf)

Medicinal value/benefits: Fennel prevents anaemia, treats indigestion and constipation, removes flatulence and helps regulate blood pressure. It improves brain function and could be used to prevent coronary disease and cancer, as well as age-related degenerative brain disorder (Faudalle et al. 2008).

9) Cumin (*Cuminum cymnium,* Apiaceae; Jeera*)*

Medicinal value/benefits: Cumin is a very good source of antioxidants. It promotes digestion, helps in treating respiratory disorders and acts as disinfectant. It helps in increasing immunity, prevents certain forms of cancer and cardiovascular disease (Jain 2006).

10) Coriander (*Coriandrum sativum*, Apiaceae; Dhaniya)

Medicinal value/benefits: Coriander contains citronellol oil, a component of essential oils in coriander. It improves cholesterol levels, treats skin disorders, regulates blood pressure and treats mouth ulcers. Various parts of the plant have been found to be having antioxidant, diuretic, anti-diabetic and anti-microbial properties (Nadeem et al. 2016).

11) Cinnamon (*Cinnamomum verum*, Lauraceae; Dalchini)

Medicinal value/benefits: Cinnamon has anti-inflammatory properties. It reduces risk of heart disease, combats bacterial infections because of the presence of active ingredient cinnamaldehyde. Oils made using this ingredient can help treat ailments from respiratory tract infection. It is used to treat digestive and gynecological ailments (Ranasinghe et al. 2013).

12) Carom seeds (*Trachyspermum ammi*, Apiaceae; Ajwain)

Medicinal value/benefits: It provides instant relief from acidity and indigestion. It treats common cough and asthama because of presence of thymol. It provides instant relief from ear ache. It is known for its stimulant, tonic and carminative properties (Singh and Maurya et al. 2004).

13) Cloves (*Syzgium aromaticum*, Myrtaceae; Lavang)

Medicinal value/benefits: Cloves are used to treat toothaches, provide relief from nausea, cough and bad breath. It is a good remedy for treating morning sickness, overcoming flatulence. Cloves have very good antioxidant properties (Shan et al. 2005).

14) Mace (*Myristica fragrans*, Myristicaceae: Javitri)

Medicinal value/benefits: Mace acts as a tonic for improving digestion. It can help in the treatment and prevention of cancer by inhibiting formation of blood vessels that feed cancerous tumors. It provides pain relief. It is known for its antioxidant and hypoglycaemic properties (Loizzo et al. 2016).

15) Basil (*Ocimum basilicum*, Lamiaceae; Tulsi)

Medicinal value/benefits: Basil fights cancer and stress, has antimicrobial properties and is hepatoprotective in nature (Uma 2001).

16**)** Shatavari (*Asparagus racemosus*, Asparagaceae)

Medicinal value/benefits: It has a soothing effect on the digestive tract, promotes healthy energy levels

and strength. It helps in maintaining a healthy female reproductive system and is used for nervous disorder, inflammation and certain infectious diseases (Alok et al. 2013).

17) Alfafa (*Medicago sativa*, Fabaceae)

Medicinal value/benefits: It works as a cleanser, helps in healing arthritis, in lowering cholesterol levels (Bora et al. 2010).

18) Stevia (*Stevia rebaudiana*, Asteraceae)

Medicinal value/benefits: Stevia is a natural sweetener and is 300 times sweeter than sugar. It helps in weight loss, regulates blood pressure, benefits oral health and helps in cancer protection (Shivanna et al. 2013).

19) Dates (*Phoenix dactylifera*, Arecaceae; Khajoor*)*

Medicinal value/benefits: Khajoor improves health of the heart, helps to regulate cholesterol, reduces stroke risk and blood pressure. As per a study date fruit has antioxidant, antimutagenic, anti-inflammatory, gastroprotective, hepatoprotective, nephroprotective, anticancer and immunostimulant properties (Tang et al. 2013).

20) Aloe vera (*Aloe vera*, Asphodelaceae)

Medicinal value/benefits: Aloe vera inhibits cancerous growth, boosts immunity, improves digestion and helps in promoting hair growth naturally. This plant has potential to cure sunburns, burns and minor cuts, and even skin cancer as per a study (Sahu et al. 2013).

21) Arjuna (*Terminalia arjuna*, Combretaceae)

Medicinal value/benefits: Arjuna helps reduce and relieve mental stress. It is a wonderful herbal remedy for boosting cardiovascular system - reduces the bad cholesterol level and increases levels of good cholesterol. It is hypolipidaemic in nature. This hypolipidaemic effect was studied in rats when they were

fed with vanilla added chocolate flavoured milk (Sawale et al. 2015).

Ayurvedic system has the oldest and one of the most developed herbal systems in the world – it has been in continuous use for at least 5,000 years. The ancient Vedic seers in India compiled and classified medicinal and healing properties of hundreds of herbs into an herbal healing system that can be accessed and utilized by anyone.

One of the latest things is the production of new flavoured milk products using herbs. Given below is the list of ayurvedic herbs that can be added to milk to make flavoured Milk:

Brahmi, tulsi , (Kumar et al. 2013), ginger (Palthur et al. 2014), shatvari (Veena et al. 2015), turmeric, alfafa, stevia, Khajoor, Aloe Vera, cumin, coriander, cinnamon, black pepper, mace, bay leaf, poppy seeds, liquorice or mulethi, jatamansi or spikenard and Pueraria tubersosa (Sawale et al. 2015). Recently a new product by the name of memory milk has been developed by a major brand in the market under the category of sterilized homogenized flavoured toned milk that contains combination of various ayurvedic herbs like brahmi, shankpushpi, tulsi, ashwagandha and other herbs.(www.amul.com/products/Amul-Memory Milk)

MATERIAL AND METHODS

We can use various herbs like cumin, coriander, cinnamon, black pepper, nutmeg, bay leaf, liquorice or mulethi, jatamansi with raw milk to produce herbal flavored Milk (Chourasia, 2011).We can try to develop a new herbal flavoured milk product using either two or three herbs (eg. Ashwagandha, Spirulina, Shatavari) that have medicinal value and also using different substitutes of sugar for sweetening.

Method of Preparation of Herbal Flavored Milk

General Procedure:-

A.

Receiving of Milk

↓

Fat Analysis

↓

Fat Adjustment

This is done by the process known as Standardization of Milk using the Pearson Square Method

↓

Pasteurization of Milk

Batch Process (Minimum 72 °C for a period of 15 s)

↓

Homogenization of Milk

(Dual Stage homogenization)

↓

Cooling of Milk

B) Preparation of Herbal Extract (Traditional Method)

1) Selection of the right plant through literature survey

2) Collecting the Plant,

3) Preparing the plant extract: It involves steps such as cutting , washing and chopping of the plant and then extraction

4) Keeping it for a period of at least 3-4 weeks before using it)

↓

Addition of Herbal Extract

(As per the recipe and the type of flavoured milk)

↓

Sugar/Honey Addition

Honey is an excellent alternative because of various benefits (Kumar et al. 2010).

After sugar / honey addition there can be 2 options given as under

Option 1:

↓

Filtration

↓

Filling into clean bottles

↓

Bottle Corking

↓

Storage under refrigerated conditions

Option 2:

Filling into clean bottles

↓

In Bottle Sterilization

(Temperature are kept during sterilization 121 °C for 15 minutes)

↓

Storage under refrigerated conditions

PLAN OF WORK

Shelf Life Study of the Final Product and its Quality Analysis:

Herbal Flavoured Milk - Its shelf life, organoleptic evaluation, microbiological analysis can be done at an interval of every seven days for a consecutive period of about six months. Shelf life of the milk can be studied with respect to using any one particular method out of the different methods that are being used currently in the industry. A few examples of the various types of methods used to study the shelf life of milk are given as under:

1) **Microfiltration:**

It is the process of forcing milk through a very fine filtration system to remove bacteria present. It also gives milk a longer shelf life, of up to 30 to 45 days (Hoffman et al, 2006). The process involves separation of cream to get skim milk which is then forced through filters. About 95% of the skim milk comes through filter. The remaining 5% of the skim milk carries away the filtered-out bacteria; which could be pasteurized to be used in other dairy products.

2) **Sensory evaluation methods:**

The shelf life of pasteurized milk is traditionally estimated by the counts of both total and psychotropic microbial load. This study examines the relationship between total and psychotropic microbial growth in milk and its sensory shelf life as measured using the Weibull hazard method. Milk stored at five constant temperatures (2, 5, 7, 12 and 15 °C) will be evaluated for both total and psychotropic microbial counts to obtain the lag time and the growth rate values. The lag time of the total and psychotropic growth responses to temperature will be studied following the Arrhenius equation. The loss of sensory quality of the milk will be followed and a log shelf life vs. temperature dependency will be studied.

Shelf life of the final product will be studied with respect to three different parameters.

1) Chemical Analysis.
2) Microbial Analysis.
3) Sensory Analysis (Organoleptic study).

In terms of chemical analysis (Jothylingam et al, 2013) the final product can be tested for the below mentioned tests:

- Fat , total solids, solid nonfat, protein, pH and acidity

In terms of microbial analysis the below mentioned tests can be done for the final product.

- Standard Plate Count (Pour Plate Method) – For checking the total bacterial growth in a given sample.
- Direct Microscopic Count.
- DCA Count - For checking Growth of Gram Positive Bacteria.
- Dye Reduction Test (Methylene Blue Reduction Test).
- Colliform Test- Escherichia coli- For checking growth of Colliform.
- Fungal count.

Organoleptic /sensory evaluation can be done on the basis of taste and various other parameters like colour and appearance, flavour, sweetness in the final product by a panel of judges on a nine Point Hedonic scale.

Statistical Analysis:

The herbal flavoured milk stored for a period of approximately one month could be studied for the effect of storage in terms of

- Chemical changes
- Microbial changes
- Flavour
- Mouth feel

Overall acceptability of the flavoured milk can be studied subsequently using the Anova technique.

PROPOSED METHODOLGY

- Selection of herbs based on literature review, findings and talking to Ayurvedic Vaids.
- Standardization of methods of extraction from selected herbal plants.
- Use of standard methods for infusion of herbal extracts into milk.
- Study of physiochemical changes like fat, TS, SNF, protein, pH, acidity through traditional and / or modern methods.
- Study of antimicrobial properties as antibacterial activity and antifungal activity.
- Study of antioxidant activity: evaluated for antioxidant activity, total phenolics, total flavonoids and secondary metabolite content. Antioxidant activity measured in terms of DPPH, Fluorence reducing after Photo bleaching, through voltametry and Fe2+ reducing ability.

OUTCOME OF THE PROJECT

At the end of the research we shall be able to have flavoured milk prepared with selective ayurvedic herbs that have medicinal value benefits in the long run and also have consumer acceptability.

This co-relation is used for prevention against a list of diseases and to overcome nutritional deficiencies.

Nutritional deficiency is almost impossible to avoid in these modern times, thus natural supplements help us for overall growth and development & increase the immunity of the body.

It helps us to overcome nutritional deficiencies and to boost our immune system. Nutritional supplements are also useful in getting rid of the toxins that are accumulated in our body.

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